

WHAT IS CLAIMED IS:

1. A collection of particles comprising lithium cobalt oxide or derivatives thereof, the collection of particles having an average diameter less than about 100 nm.

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2. The collection of particles of claim 1 wherein the lithium cobalt oxide or derivatives thereof comprise a substituted lithium cobalt oxide with another metal selected from the group consisting of Ni, Mn, B, Al, Mg, Ba, Sr, Ca, Cr, Fe, V, Ti and combinations thereof.

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3. The collection of particles of claim 1 wherein the lithium cobalt oxide or derivatives thereof comprise a substituted lithium cobalt oxide with a stoichiometry of $\text{LiCo}_{1-y}\text{Me}_y\text{O}_2$, $0 < y \leq 0.5$, where Me is Ni, Mn, Al or combinations thereof.

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4. The collection of particles of claim 1 wherein the lithium cobalt oxide or derivatives thereof comprise a substituted lithium cobalt oxide with a stoichiometry of $\text{Li}_2\text{CoMnO}_4$.

5. The collection of particles of claim 1 wherein the lithium cobalt oxide or derivatives thereof comprise a substituted lithium cobalt oxide with a stoichiometry of $\text{Li}_2\text{CoNiO}_4$.

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6. The collection of particles of claim 1 wherein the lithium cobalt oxide or derivatives thereof comprise a substituted lithium cobalt oxide with a stoichiometry of $\text{Li}_2\text{CoAlO}_2$.

7. The collection of particles of claim 1 having an average diameter from about 5 nm to about 25 nm.

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8. The collection of particles of claim 1 wherein the collection of particles have a distribution of particle sizes such that at least about 95 percent of the particles have a diameter greater than about 40 percent of the average diameter and less than about 160 percent of the average diameter.

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9. The collection of particles of claim 1 wherein effectively no particles have a diameter greater than about three times the average diameter of the collection of particles.

10. A battery comprising a cathode, the cathode comprising the collection of particles of claim 1.

11. A collection of particles comprising lithium nickel oxide or derivatives thereof, the collection of particles having an average diameter less than about 100 nm.

10 12. The collection of particles of claim 11 wherein the lithium nickel oxide or derivatives thereof comprise a substituted lithium nickel metal oxide wherein the metal is selected from the group consisting of Mn, B, Co, Al, Mg, Ba, Sr, Ca, Cr, Fe, V, Ti and combinations thereof.

15 13. The collection of particles of claim 11 wherein the lithium nickel oxide or derivatives thereof comprise lithium nickel aluminum oxide.

14. The collection of particles of claim 11 wherein the lithium nickel oxide or derivatives thereof comprises $\text{Li}_x\text{Ni}_{1-y}\text{Me}_y\text{O}_2$, wherein Me is Mn, B, Co, Al, Mg, Ga, Ba, Sr, Ca, Cr, Fe, V, Ti or combinations thereof and wherein $0.8 \leq x \leq 1$.

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15. The collection of particles of claim 14 wherein $0 \leq y \leq 0.2$.

16. The collection of particles of claim 14 wherein M is Co and wherein $0 \leq y \leq 0.5$.

25 17. The collection of particles of claim 11 wherein the particles have an average diameter of from about 5 nm to about 25 nm.

18. The collection of particles of claim 11 wherein the collection of particles have a distribution of particle sizes such that at least about 95 percent of the particles have a diameter greater than about 40 percent of the average diameter and less than about 160 percent of the average diameter.

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19. The collection of particles of claim 11 wherein effectively no particles have a diameter greater than about three times the average diameter of the collection of particles.

5 20. A battery comprising a cathode, the cathode comprising the collection of particles of claim 11.

21. A collection of particles comprising lithium titanium oxide or derivatives thereof, wherein the collection of particles have an average diameter less than about 100 nm.

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22. The collection of particles of claim 21 wherein the lithium titanium oxide or derivatives thereof comprises LiTi_2O_4 .

15 23. The collection of particles of claim 21 wherein the lithium titanium oxide or derivatives thereof comprises LiTiAlO_4 .

24. The collection of particles of claim 21 wherein the lithium titanium oxide or derivatives thereof comprises $\text{LiTi}_{2-y}\text{Al}_y\text{O}_4$, $0 < y \leq 1$.

20 25. The collection of particles of claim 21 wherein the lithium titanium oxide or derivatives thereof comprises $\text{Li}_4\text{Ti}_5\text{O}_{12}$.

26. The collection of particles of claim 21 wherein the lithium titanium oxide or derivatives thereof comprises $\text{Li}_{1+x}\text{Ti}_{2-x}\text{O}_4$, $0 \leq x \leq 1/3$.

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27. The collection of particles of claim 25 wherein $0.01 \leq x \leq 0.25$.

28. The collection of particles of claim 21 wherein the lithium titanium oxide or derivatives thereof comprises $\text{Li}_4\text{Ti}_3\text{Al}_2\text{O}_{12}$.

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29. The collection of particles of claim 21 wherein the lithium titanium oxide or derivatives thereof comprises $\text{Li}_4\text{Ti}_{5-y}\text{Al}_y\text{O}_{12}$, $0 < y \leq 2$.

30. The collection of particles of claim 21 wherein the particles have an average diameter
5 from about 5 nm to about 25 nm.

31. The collection of particles of claim 21 wherein the collection of particles have a distribution of particle sizes such that at least about 95 percent of the particles have a diameter greater than about 40 percent of the average diameter and less than about 160 percent of the
10 average diameter.

32. The collection of particles of claim 21 wherein effectively no particles have a diameter greater than about three times the average diameter of the collection of particles.

15 33. A battery comprising a anode, the anode comprising the collection of particles of claim 21.

34. A battery comprising an anode and a cathode, the anode comprising lithium titanium oxide and the cathode comprising lithium manganese cobalt oxide.

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35. The battery of claim 34 wherein the lithium titanium oxide comprises LiTi_2O_4 .

36. The battery of claim 34 wherein the lithium titanium oxide comprises $\text{Li}_4\text{Ti}_5\text{O}_{12}$.

25 37. The battery of claim 34 wherein the lithium manganese cobalt oxide comprises $\text{Li}_x\text{MnCoO}_4$, $x \leq 1$.

38. The battery of claim 34 wherein the lithium manganese cobalt oxide comprises LiMnCoO_4 .

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39. The battery of claim 34 wherein the lithium titanium oxide comprises a collection of particles with an average diameter less than about 100 nm.

5 40. The battery of claim 34 wherein the lithium titanium oxide comprises a collection of particles with an average diameter from about 5 nm to about 25 nm.

41. The battery of claim 34 wherein the lithium manganese cobalt oxide comprises a collection of particles with an average diameter less than about 100 nm.

10 42. The battery of claim 34 wherein the lithium manganese cobalt oxide comprises a collection of particles with an average diameter from about 5 nm to about 25 nm.